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A NEW SPECIES OF WATER SCAVENGER BEETLE, *COELOSTOMA* (S. STR.) *TINA* (COLEOPTERA: HYDROPHILIDAE: SPHAERIDIINAE), FROM KENYA, EASTERN AFRICA

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Abstract.—A new species of African water scavenger beetle, ***Coelostoma tina* Spangler and Steiner**, is described. The specimens were collected in an eastern African section of the Rift Valley from lagoons in Lake Magadi, Kenya, and pools adjacent to the lake. The water in these habitats is hypersaline and highly alkaline and shores are salt encrusted. The adults are described and illustrated with line drawings and scanning electron micrographs. Habitat notes and photographs of the biotope are given.

Key Words: aquatic insects, Afrotropical fauna, extreme environments, salt lakes

The new species of water scavenger beetle described in the following account was collected by Scott E. Miller and Tina M. Kuklenski during biodiversity fieldwork in Kenya, eastern Africa. The specimens were collected in the Rift Valley at the site of the Magadi Soda Company in hypersaline and highly alkaline water in lagoons in Lake Magadi and in adjacent pools. The specimens belong to the genus *Coelostoma*, a speciose genus that is widely dispersed in the Eastern Hemisphere tropics. Most recently, Hansen (1999) in his catalog of the Hydrophiloidea of the world listed 92 species and 9 subspecies of *Coelostoma*. Of these taxa approximately 70% are Afrotropical, 25% are Oriental, and the remaining 5% are reported from the Palearctic and Australian regions. Most species inhabit lentic freshwater habitats in weedy margins. Some, and probably most species, can fly and are attracted to ultraviolet, mercury vapor, and incandescent lights. Some species are highly vagile, therefore, widely distributed (fide Hansen 1999) such as *Coelostoma orbiculare* (Fabricius) in the Palearctic Region from Britain to West Siberia, south to Spain and east to Japan. Also, *Coelostoma fabricii* (Montruzier) is reported by Hansen from many countries in the Oriental and Australian Regions as well as the Pacific Islands (Hawaiian Islands).

The genus *Coelostoma* was described by Brullé (1835). Since that time numerous new species were described by a variety of authors, mostly in small contributions and often under other incorrect generic or species names. The genus was first revised by d'Orchymont (1936), 101 years after Brullé originated the genus. Fortunately d'Orchymont, a prolific hydrophilid specialist, described and illustrated the aedeagi of his 15 new species plus 9 species described by earlier authors. In his study he found that it was absolutely necessary to ignore the females and to perform the tedious extractions of the aedeagi, illustrate them, and segregate species on their differences. In a subsequent publication, d'Orchymont (1940) divided the genus into two subgenera, the nominate *Coelostoma* (s. str.) and his new subgenus, *Lachnocoelostoma.*

Later, Mouchamps (1958) followed d'Orchymont's advice and primarily based his descriptions of 25 new species and redescriptions of six previously described species on their distinctive male genitalia. Occasionally, he noted differences in size and density of punctation and microreticulation on dorsal and ventral surfaces of some species. However, both authors essentially used only the distinctive aedeagi to distinguish the different species included in their publications. In Mouchamps's article noted above, he also described two new subgenera, *Hammacoelostoma* and *Holocoelostoma,* and provided a key to the four subgenera presently known.

Coelostoma (s. str.) *tina* Spangler and Steiner, new species

(Figs. 1–10)

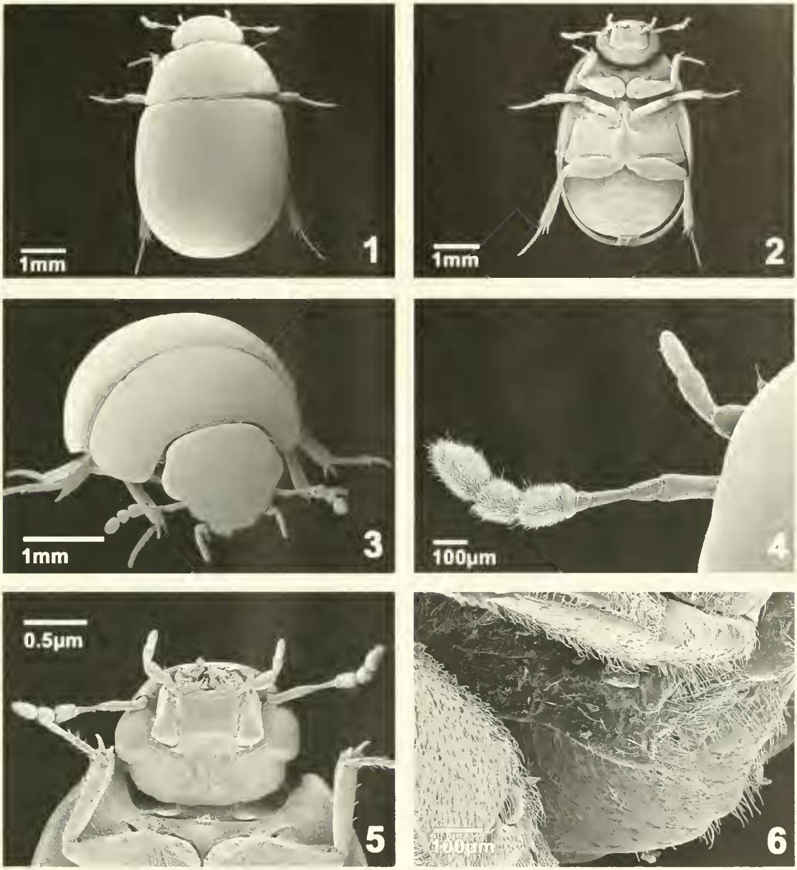
Diagnosis.—Color mostly black, shining, body oval, strongly convex dorsally (Figs. 1–3); length 4.6–5.5 mm. Antenna 9 segmented; base concealed under lateral shelf of head (Figs. 4–5). Mesosternal process sagittate and without a small transverse carina (Figs. 6–7). Tarsal claws simple. Metasternum with posterior process extended between metacoxae and forked apically (Fig. 8). Profemora and mesofemora with dense, stiff, hairlike setae on upper surface and similar but sparser setae on lower surface. First abdominal sternum not carinate longitudinally on midline. Last abdominal sternum rounded, not notched apicomedially. Aedeagus distinctive (Figs. 9–10) for this new species, resembling most closely that of *C. austrine* Mouchamps (1958) but in general more elongate with apices of the parameres less pointed.

Holotype ♂.—Body form and size: Oval, strongly convex dorsally. Length 5.3 mm; width 3.1 mm.

Color: Black and shiny dorsally. Venter black except tarsi dark reddish brown. Basal antennal segments 1–6 glabrous and reddish brown; apical segments 7–9 pubescent and dark reddish brown. Labrum reddish brown across anterior margin and bearing short golden setae. Maxillary and labial palpi reddish yellow. All visible abdominal sterna with reddish brown oval spot adjacent to lateral margins.

Head: Shiny, moderately coarsely and densely punctate, punctures separated by ½ to 3 times puncture diameter; surface between punctures finely microreticulate. A patch of hydrofuge pubescence posterolateral to each eye continues under head over genae except for a glabrous, longitudinal, cariniform ridge on midline between two similarly glabrous, but angular ridges (Fig. 5) bordering each hydrofuge pubescent patch. Labrum finely, densely punctate dorsally and shallowly and broadly emarginate anteriorly. Mentum rimmed, shallowly emarginate apicomedially, shallowly concave on anterior half, moderately coarsely and densely punctate on posterior half. Submentum punctate as on mentum but over entire surface.

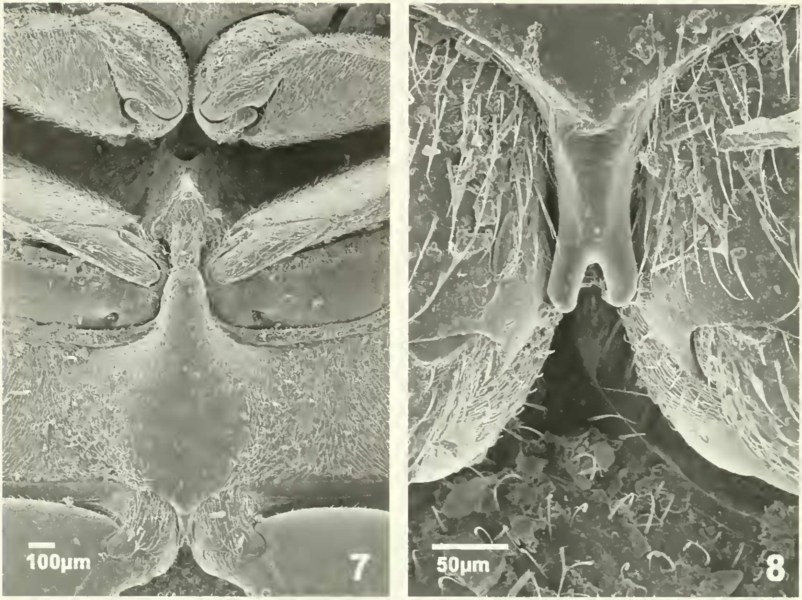
Thorax: Pronotum widest subbasally, lateral margins arcuate; anterolateral and posterolateral angles rounded; punctures on disc moderately coarsely, densely punctate; punctures separated by 1 or 2 times puncture diameter; surface between punctures microreticulate. Prosternum with only a minute denticle apicomedially followed by a low, ovoid medial hump. Mesosternum with broad sagittate medial protuberance with an apical hooklike process (Fig. 6); in ventral view, sides rimmed; a longitudinal, pubescent, medial process extends posteriorly and meets metasternal process between mesocoxae (Fig. 7). Metasternum shiny and ovately raised medially; densely and coarsely punctate laterally and more than on raised discal area; posterior process extended between metacoxae and apex bifurcate (Fig. 8). Metepisterna pubescent. Procoxa sparsely, finely setose. Profemur densely punctate and pubescent on basal four-fifths on all sides except on upper (leading) edge. Mesofemur densely, coarse-



Figs. 1–6. *Coelostoma tina*, male, scanning electron microscope images. 1, Dorsal habitus. 2, Ventral habitus. 3, Oblique frontal view. 4, Left antenna and maxillary palpus, dorsal view. 5, Head, ventral view. 6, Mesosternal process, lateral view.

ly punctate as on profemora. Metafemur similar to mesofemur but with fewer coarse punctures. Elytron with random punctures moderately coarse and dense, punctures separated by 1-2 times diameter of a puncture; side nearly vertical from base to posterior end of metepisterna; with sutural stria extending from apex of scutellum where stria is separated from suture by diameter of an adjacent elytral puncture then deepening and widening to a distance equal to the diameters of 4 adjacent punctures at elytral apex. Scutellum an elongate triangle; coarsely and densely punctate but more finely microreticulate than on pronotum.

Genitalia: Aedeagus (Fig. 9) with me-



Figs. 7–8. *Coelostoma tina*, male, scanning electron microscope images. 7, Coxae and thoracic sterna, showing sagittate mesosternal process. 8, Forked process of metasternum between metacoxae.

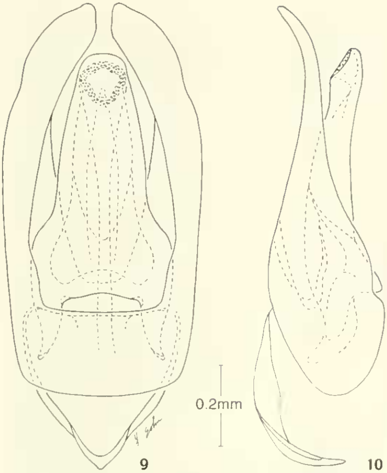
dian lobe wide at base, then tapering to apex; parameres flattened and widest at apex, angled inward, and upturned on apical ⅓ (Fig. 10); gonopore opening ventrally at apex.

Type data.—Holotype (♂): KENYA: Kajiado District, Lake Magadi, NW Lagoon at shortcut road, 1.805°S, 36.051°E, ca. 600 m; Station 3, 31 January 1999, S. E. Miller & T. M. Kuklenski collectors. Allotype and 6 paratypes, same data; 24 paratypes, same data except: NW Lagoon under salt encrusted rocks at edge of lake, 11 June 1997, 1.850°S, 36.217°E; 600 m. The holotype and 3 paratypes will be deposited in the National Museum of Kenya, Nairobi. Paratypes will be deposited in the National Museum of Natural History, Smithsonian Institution, Washington, DC; The Natural History Museum, London; the Central African Museum, Tervuren, Belgium; and the Transvaal Museum, Pretoria, South Africa.

Etymology.—We take pleasure in naming this beetle for Tina Kuklenski Miller, who, according to Scott Miller, urged him to stop at the site and take samples of insects, leading to the discovery of this new species.

Habitat and History

According to investigations by Vincens and Casanova (1987) and Roberts et al. (1993), Lake Magadi lies at 1°50′S, 36°18′E, 600 m above sea level and is a closed lake at the southern end of Gregory Rift Valley in Kenya (Fig. 11). Exploited commercially since 1917 by the Magadi Soda Company, it is described as an active salt lake with thick trona deposits and concentrated alkaline brines. The climate is hot



Figs. 9–10. *Coelostoma tina*, male genitalia, line drawings. 9, Dorsal view. 10, Lateral view.

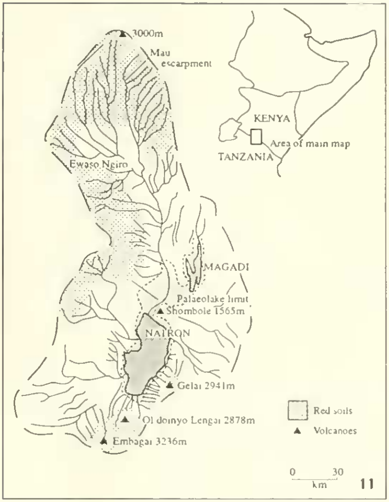


Fig. 11. Map of the features and location of Lake Magadi-Natron basin, Kenya (from Roberts et al. 1993), the type locality of *Coelostoma tina*.

and dry which, along with the prevailing lava and rocks, produces a harsh, semi-arid landscape of grassland and shrubland. Hand axes and other artifacts were discovered in 1942 by M. Leakey, and early hominid fossils were described from the region (Leakey and Leakey 1964), indicating that the area has a long history of human utilization. Baker (1958) reported that the first European to visit the area was a geologist, A. Fischer, in 1883. He was followed by numerous other geologists and a chemist, J. A Stevens (ca. 1930), from the Magadi Soda Company. Stevens provided valuable analyses of alkaline spring waters, lagoon liquors, and various salts that he found in Lake Magadi and adjacent hypersaline and alkaline waters. The lake is fed almost entirely by ground water inflows from modern springs (with their pH ranging from 9–9.5) while the larger Lake Natron, which was formerly connected to Lake Magadi, receives substantial surface water inflows primarily from the Ewaso Ngiro River. Salinities of the various parts and side pools of the lake probably fluctuate with rainfall and evaporation.

Biota and Endemism

The biota of Lake Magadi and its environs has not been thoroughly surveyed; selected taxa have been studied but the insect fauna is virtually unknown. Roberts et al. (1993) refer to two flamingo nurseries in a lagoon in the northwestern section of Lake Magadi (these birds currently provide an important tourist attraction to many East African lakes). Because flamingos usually feed on zooplankton, phytoplankton, crustaceans (amphipods, brine shrimp), insects (ephydrid and chironomid larvae), oligochaetes, etc. (Allen 1956), it seems reasonable that some of these organisms occur in the shallow water in or near the flamingo nurseries of the lake. However, Lesser Flamingos (the species breeding at Lake Magadi) are specialized feeders on diatoms and blue-green algae, and larger food items such as midge larvae and copepods occur

Figs. 12–13. Biotope of the type locality of *Coelostoma tina* at Lake Magadi, Kenya. 12, Lake margin and side pools with emergent rocks. 13, Part of lake basin with shallow pool in foreground, one of the collection sites. Photographs by R. Copeland.

in the less extremely alkaline lakes of the region (Brown 1973). The extreme environment of Magadi and the historical exploitation of the site makes the occurrence of the new species of water scavenger beetle most remarkable.

Scott Miller (in litt.) reported that the lake and pools have many emergent rocks that provide hiding places for invertebrates. In association with *Coelostoma tina*, Miller and Kuklenski collected the following organisms from the northwest lagoon: a probably new species of spider belonging to the genus *Wadicosa*; two whirligig beetles belonging to the genera *Orectogyrus* and *Gyrinus*, and the cosmopolitan earwig, *Labidura riparia* (Pallas).

In addition, the following organisms from the Lake Magadi system have been described or discussed by various authors as follows. The tiger beetle *Lophyra pseudodistans* (Horn) is apparently endemic to the area (Werner 1993). A dwarf cichlid fish, *Tilapia grahami* Boulenger is presently living in more dilute parts of the lake as has been reported by Baker (1958); this species has been recently used as a subject for an experimental study of its adaptations to its highly alkaline environment (Wood et al. 1994). Microbiologists isolated and described a new species of haloalkaliphilic bacterium, *Natronobacterium vacuolata* Mwatha and Grant (1993) from Lake Magadi. The identifications of two diatoms, *Nitzchia lacuum* and *N. pura*, were used by geologists (Roberts et al. 1993) to recognize assemblages of these two species that reflected abrupt changes in lake water chemistry, notably pH and conductivity as lake water changed to more concentrated and alkaline conditions. They concluded that the associated fall in lake level led to the separation of Lake Magadi from Natron into two bodies soon after 10,000 yr BP as inferred from the diatom assemblages and other geochemical indicators. With the aquatic arthropods of the region so wanting for study (in spite of the historical use and interest in the area) it would be most interesting to compare the modern assemblages of species of the two lakes.

Acknowledgments

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